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Telling Well the Story of the Yellow River's Natural History in the Zhengzhou Region *

XU Hailiang

General Secretary Xi Jinping stated at the Symposium on Ecological Protection and High-quality Development of the Yellow River Basin, "Yellow River culture is an important part of Chinese civilization and the root and soul of the Chinese nation. We should thoroughly explore the contemporary value contained in Yellow River culture, tell the stories of the Yellow River well, carry forward the historical context, strengthen cultural confidence, and gather spiritual strength for realizing the Chinese Dream of great national rejuvenation."

We should respond to the call, earnestly learn about the humanistic and natural history of the Yellow River, and tell the stories of the Yellow River well.

The "stories of the Yellow River" include not only those about the humanistic, social history and modern development of the river, but also those concerning its natural evolution, disasters and environmental history. They cover both the pure natural evolution of the Yellow River and its evolution under human intervention. Only by having a thorough understanding of the entire history of the Yellow River can we implement the guiding principles of the Party Central Committee and protect and develop the Yellow River well today.

The geographical location of the Zhengzhou area once lay at the top of the Ningzui large alluvial fan of the Yellow River formed in the Late Pleistocene and later at the apex of the Taohuayu alluvial fan of the Yellow River formed in the Holocene, making it the most crucial area for the evolution of the lower reaches of the Yellow River in recent times. Over the past 150,000 years or more than years, the water and sediment of the Yellow River have filled the areas including Jiyuan, Jiaozuo, Xinxiang and the regions further downstream to the north of the present-day Yellow River, and scoured the areas such as Gongyi, Xingyang, the urban area of Zhengzhou, Xinzheng, Zhongmu, Weishi, the Airport Economy Zone, Yanling, Fugou and the regions further downstream to the south of the present-day Yellow River. These areas were once floodplains of the ancient Yellow River.

At the end of the Late Pleistocene, the Guangwu Low Hills's Western Distributary Channel (a branch of the main river course) of the Yellow River, diverging from the main course, ran through the present-day Xingyang, the western and southern parts of the urban area of Zhengzhou, passed through Xinzheng and the Airport Economy Zone, flowed into the ancient Weishui River, and then emptied into the Huai River via the Ying River distributary channel. During the same period and the Holocene, the Guangwu Low Hills's Eastern Distributary Channel of the Yellow River, also diverging from the main course, ran through the eastern part of the present-day urban area of Zhengzhou and Zhongmu, and flowed into the Huai River via the ancient Bianshui and Ying River distributary channels. In Zhengzhou, over a span of just 150,000 years and more than years, this has given rise to a magnificent

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environmental history of the Yellow River.

When talking about the Yellow River, we need to truthfully narrate this remote story—the history of the vicissitudes and great changes in the Zhengzhou Region.

I do not emphasize the significance of the Yellow River culture in Zhengzhou simply because I am here today. Then why should we attach great importance to the Yellow River culture and Zhengzhou? Xu Guangchun, former Secretary of the CPC Henan Provincial Committee, specially stressed at the 10th Anniversary Celebration of the Zhengzhou Research Institute of the Origins of Chinese Civilization and Songshan Civilization in 2021: "General Secretary Xi clearly stated at the Symposium on Ecological Protection and High-quality Development of the Yellow River Basin that Chinese civilization has a history of more than 5,000 years. Yellow River culture is an important part of traditional Chinese culture and the root and soul of the Chinese nation. Where does this root and soul lie? ... It is the Yellow River culture. Moreover, the General Secretary elaborated on this in more specific terms. I think we should fully understand: where lies the core of the Yellow River culture? The core of the Yellow River culture is the Central Plain Culture. Where did the Central Plain Culture originate? It originated in the middle and lower reaches of the Yellow River ... Where is the core of the birthplace of Chinese civilization? ..."

My understanding of how Zhengzhou underwent the transformation from a vast ocean to fertile farmland has been a long process of learning and exploration. Back in the 1970s, when I worked in Shenqiu county, long-distance buses always took the old route passing through Tongxu-Weishi-Xinzheng. Every time the bus traveled from Daying in Weishi county to Sanguanmiao in Zhongmu county, sand ridges stood stiffly along the road, shaded by a jumble of trees and overgrown with thorns, presenting a scene vividly reminiscent of the "Wild Boar Forest" described in *Water Margin*! When passing through places like Xuedian and Xiaoqiao in Xinzheng, the rolling mounds and crisscrossing deep gullies, blanketed with yellow sand, were unmistakably the landscape features left by rivers. Could it be that the Yellow River once flowed through here?!

In 1981, the main current of the Yellow River shifted away from the Mangshan Pumping Station, leaving the water diversion canal dry. Workers, government officials and students in Zhengzhou went to the river beach below the pumping station to dig a new water diversion channel. The school principal in charge of teaching asked me: Zhengzhou locals claim that Mangshan is a product of aeolian accumulation, while others argue it is of fluvial origin—which statement is more scientifically sound? These questions have occupied my thoughts for 40 years! In the more than ten years since my retirement, through long-term observation and exploration, I have finally begun to make some sense of them. This process has involved, among other methods, using drilling and geophysical techniques to decipher the natural mysteries recorded in Zhengzhou's "geomorphological tome". In the past, people emphasized reading the classics of humanistic sages, but as we delved into these written works, we forgot that there are also precious "books" of nature—the geomorphological records and astronomical observations.

From the Archaean Eon to the Cenozoic Era in geological history, the Cathaysian Oldland has undergone repeated cycles of formation, submergence, re-emergence and destruction, as well as repeated convergence and splitting. The fundamental symbols of survival and development have composed the main theme of time and space, and also forged the profound, steadfast and indomitable spirit of the land of China.

In the Neogene Period, the Ordos Fault Block in western China evolved into an uplifting accumulation plain, becoming a natural stage for the deposition of loess dust. By the end of the Tertiary Period and the

beginning of the Quaternary Period, the meticulous craftsmanship of nature had reshaped the land of China west of the Taihang Mountains and Songshan Mountains time and again. A vast and smooth landscape, consisting of bedrock hills, basins and ancient river terraces, had taken shape.

Bedrock mountainous areas—such as the Qinling Range, Liupan Mountains and Lüliang Mountains, which are intensely uplifting regions affected by block faulting, as well as the Songshan-Jishan Mountains and Taihang Mountains west of the Beijing-Guangzhou Railway—have developed into moderately or heavily eroded and dissected mountainous areas. It has been difficult for loess dust carried by westerly winds to accumulate on the mountain summits, and even today, exposed bedrock remains in these regions.

The orogeny of the Songshan-Jishan Mountains resulted in crustal uplift, which persisted as intermittent neotectonic movement during the Quaternary Period; on some occasions, such tectonic uplift was even quite intense. This phenomenon is still a consequence of the stress radiation from massive crustal deformation—continuously propagating northward and eastward—triggered by the collision of the Indian Plate with the Eurasian Plate and the rapid uplift of the Qinghai-Tibet Block due to compression and wedge-like subduction. For the Zhengzhou Region, this constitutes the primary manifestation of landform formation and Yellow River evolution driven by the earth's internal forces.

In the final analysis, neotectonic movement is a rare golden key that unlocks the mysterious door to the environmental history of landform evolution, hydrological system development and the origin of civilization in the Zhengzhou Region. Climatic evolution is another important factor in environmental changes, which will not be elaborated on here for the time being.

Tectonic forces have shaped the basic topographic relief of the Zhengzhou Region. In terms of geomorphological structure, the southwestern part of downtown Zhengzhou is dominated by the Songshan-Jishan uplift, while the Xinzheng uplift runs through its southern region; the northeastern part is under the control of the Kaifeng Depression, thus forming a fundamental topographic pattern of high elevation in the southwest and low-lying terrain in the northeast. The piedmont alluvial-proluvial plain is a component part of the North China Plain.

As a whole, the land of Zhengzhou consists of a large Yellow River alluvial fan and its associated fluvial landforms. Over the past 150,000 years since the Late Pleistocene, the landforms of most areas in Zhengzhou have been basically shaped by the Yellow River, with fluvial dynamics acting as the primary external agent of landform formation.

Whether it is Guangwu low hills, which has not been completely eroded by the Yellow River, or Maling Gang (a hilly region in Henan), which was leveled for the construction of Xinzheng Airport, Foxconn and BYD manufacturing bases (hydrogeologists point out that Guangwu low hills and Maling Gang, extending to Weishi, are all Yellow River terraces dating back to the early Late Pleistocene, which were later uplifted to form ridges and mounds); whether it is the alluvial plains flanking the Beijing-Guangzhou Railway, or the ancient and modern rivers and lakes in central Zhengzhou—all these features have gradually taken shape and evolved during the development of the Yellow River alluvial fan. It can thus be argued that the city proper of Zhengzhou is situated exactly on river terraces! Moreover, all the material remains of ancient and modern human societies in Zhengzhou happen to lie on the vast, thick surface of the Yellow River alluvial fan.

The late Quaternary geomorphological processes and the evolution of river-lake systems in Zhengzhou have constructed the basic stage for the unfolding of human civilization. On the current geomorphological maps of the Huang-Huai-Hai Plain, the exposure of geomorphological layers dating back to the early Late

Pleistocene is insufficient, which may well be attributed to reworking by subsequent alluvial-proluvial processes—including erosion and superimposition—with the surface further covered by Holocene fluvial and aeolian deposits.

Zhengzhou is located at the most critical transitional zone between China's second and third topographic steps, boasting extremely diverse topographic relief and elevation gradients, which have provided an optimal environment for the reproduction and evolution of all living beings.

The three major watercourses of the He (Yellow River), Ji (Ji River), and Huai (Ying River) interweave and interlink across the Zhengzhou Region, forming a spider-web-like river system at the top of the delta. As the Yellow River advanced through alluviation, three large shallow lakes and marshes were left at the front of the alluvial fan: the Xingyang-Guangwu Marsh in western Zhengzhou, and the Xing Marsh and Putian Marsh in the central and eastern parts, which served as the final destinations for numerous water bodies.

Local rivers originated and meandered through Songzhu Hill, Mei Hill and Taishan Hill. The name "Songzhu" seems to have embodied the ancient people's observation of the low hills and hills in front of the Songshan Mountain, as well as the shallow Xingyang-Guangwu Marsh, where sandbars emerged and disappeared, mounds and hills stretched across, and cottages dotted the landscape.

The comb-shaped striped mounds in the Zhengzhou Airport Economic Zone and western Weishi county—resembling the "Wild Boar Forest" described in *Water Margin* with their linear elevated hills and tree-covered sand dunes—have a groundwater depth 10 to 20 meters deeper than the surrounding plain areas. Could this also be a major area uplifted by the Xinzheng uplift, with the ancient Yellow River bed from over 100,000 years ago lying beneath? Are these comb-shaped ridges exquisite remains meticulously carved by massive floods during the transition to the Holocene? They stand in distant contrast to their contemporary counterpart, the Guangwu Ridge, in northern Zhengzhou. Stretching from the Airport Economic Zone to Weishi county, these mounds and ancient lakes/wetlands connect end to end, serving as topographic relics of a history marked by catastrophic floods. It is said that King Mu of Zhou (Western Zhou Dynasty) was once feasted here by the monarch of the State of Xu.

The Yellow River, with its eastern and western overflow channels of Guangwu, the Songji uplift, the Xinzheng uplift, the monsoon climate that fluctuated between northward and southward shifts, the ceaseless river and lake systems, the drifting loess dust from ancient loess deposition periods, the aeolian deposits shaped by changing underlying surfaces, and the extensive plant communities—all these have endowed the Zhengzhou Region with vibrant vitality.

When the Holocene "Megathermal Period"—a climatic optimum in archaeological terms—arrived, the Yellow River of our culture and the Yellow River of humankind stepped onto this grand stage as Homo sapiens emerged. Coinciding with the advent of an agricultural climate optimum, it nurtured the blooming of a splendid civilization.

Even in periods of extremely unfavorable climate, when you walk into the mountain valleys of Xing-Mi (encompassing Xingyang and Mixian counties) and encounter landscapes of green hills and clear waters that resemble those in southern China—such as the Zhijidong Site—you will surely believe and understand how the ancestors of Zhengzhou navigated the hardships of the harsh environment during the last glacial period of the Quaternary with composure and resilience.

As the Zhengzhou Region underwent alternating subsidence and uplift alongside the Kaifeng Depression and Jiyuan Depression, it was in a state of subsidence during the early and middle stages of the Late Pleistocene.

At that time, the river water rushing down from Bali Gorge could sweep freely across the present-day regions of Jiyuan, Mengzhou, Gongyi and Xingyang, with the water and sediment of the Yellow River reaching all the way to the foothills of the Taihang Mountains and Songshan-Jishan Mountains. This constituted the major geological and fluvial geomorphological background for the existence of the southern distributary channels of the Yellow River at the end of the Late Pleistocene.

By the late stage of the Pleistocene, the area east of the present-day Beijing-Guangzhou Railway remained in a state of subsidence, while the entire area west of the railway reversed its downward trend and started to uplift. As the terrain on both banks of the Yellow River in the west gradually rose, the river water could only flow into the hinterland of Xingyang through the Sishui Estuary, overflow the riverbanks or via Niukouyu during major flood seasons.

By the early Holocene, the apex of the large Yellow River alluvial fan had shifted southward from Ningzui to Taohuayu. The major floods of the Yellow River were blocked by the elevated riverbanks and could no longer flow smoothly into the hinterland of Xingyang. Therefore, roughly 10,000 years ago, the distributary channel west of Guangwu low hills in Zhengzhou dried up as it lost its water source from the Yellow River. Consequently, the floodwaters from the southern foothills of the Taihang Mountains could no longer reach Xingyang, causing the legendary ancient Ji River to dry up as well. It then had to take its source from the mountains and rivers in the southwestern part of Zhengzhou. In the river valley lowlands in front of the Xingyang-Guangwu geosyncline in the west, seasonal shallow lakes and marshes were formed, covering an area of as much as 100-200 square kilometers.

During historical periods, the Ji River—originating from water sources in Zhengzhou—gradually dried up, leaving the Zhengzhou region spanning the two major river basins of the Yellow River and the Huai River. By the era of *Shan Hai Jing* (Classic of Mountains and Seas) and *Shui Jing Zhu* (Commentary on the Water Classic), approximately 70% of the surface runoff in the Zhengzhou area flowed into the Yellow River, while 30% emptied into the Huai River. All western tributaries, including the Si, Suo, Xu, and Huang rivers, discharged into the Yellow River.

With the rise of human-engineered projects, the Northern Song Dynasty planned a canal network around its capital Bianjing in 962 CE, diverting water from the Suo, Xu, and Huang rivers by excavating the Jinshui River (literally "Golden Water River") to supply the capital. Since Zhengzhou lay west of Bianjing, the river was named "Jinshui," though it has no connection to the modern Jinshui River in Zhengzhou. From this point, the Suo and Xu rivers in western Zhengzhou flowed eastward via this ancient Jinshui River, no longer entering the Yellow River.

Subsequently, due to repeated southward flooding of the Yellow River into the Huai River basin during the Yuan, Ming, and Qing dynasties, coupled with artificial dredging and drainage works, the Jialu River water system gradually took shape. Most of the runoff in Zhengzhou was redirected to the Jialu River, which empties into the Ying River and eventually the Huai River. The formal existence of the Jialu River was officially recognized in the imperial court archives of the Qianlong (Qing Dynasty).

To date, the runoff distribution in Zhengzhou has reversed: 30% now flows into the Yellow River and 70% into the Huai River. The entire city's summer rainwater and flooding are discharged solely through the Jialu River. Drastic changes in the water system amid long-term environmental evolution ultimately contributed to the catastrophic flooding caused by the extreme rainstorm as Zhengzhou in July 2021.

Observing the distribution of Paleolithic and Neolithic cultural sites in the Zhengzhou region, a number of confirmed Paleolithic sites are located on the elevated low hills, foothills, and loess terraces west of the Beijing-Guangzhou Railway. These include the Zhijidong, Lijiagou, Laonainai Miao, Zhaozhuang, Bianfudong, Songjiagou, Xishi, and Honggou sites, as well as the Paleolithic culture at Lingjing in Xuchang (situated on the southern wing of the Yellow River Flood Plain). Meanwhile, numerous Neolithic cultures from different periods are scattered across both the hills and plains of the Zhengzhou region.

In the past, the exact meaning of "Yellow River Culture" was unclear. Today, however, it can be stated with certainty that the ancient cultures in downtown Zhengzhou and its surrounding areas are typical manifestations of Yellow River Culture. Furthermore, the Zhengzhou region, characterized by the intimate integration of rivers and lakes, gave rise to an ancient "river-lake culture." This constitutes the environmental secret behind the eternal vitality of Zhengzhou's Yellow River Culture.

As for the Xia, Shang, and Zhou dynasties, archaeological remains of settlements and cities at various levels are widespread across the Central Plains. A preliminary overview reveals that the accumulated geographical density of these ancient settlements and fortresses is slightly lower than that of production team-level villages in the 1970s but far higher than that of production brigade-level administrative units of the same period—particularly within the boundaries of downtown Zhengzhou and the Xingyang area. Clearly, the Zhengzhou region is the most typical high-density development area of ancient Yellow River Culture.

Since the dawn of the new century, the cultural relics and archaeology authorities of Zhengzhou City have provided us with opportunities to explore Zhengzhou's ancient environment and study paleogeography, integrating the humanities and sciences with the research on environmental history through mutual penetration. I have gained profound insights into certain aspects of the natural history of the Yellow River in Zhengzhou, thanks to the profound enlightenment and inspiration derived from the archaeological cultures of the Zhengzhou region. The natural history of the Yellow River in Zhengzhou and its humanistic history are inseparable and organically integrated. When it comes to the natural history of the Yellow River, it is inevitably intertwined with the human history of the Central Plains. In exploring the historical environment of the Zhengzhou region, questions such as how the ancients survived here and what they were thinking have always aroused my interest and contemplation.

From flood control and water resources to waterfront environments along the Yellow River in Zhengzhou, the river's connection with the people of Zhengzhou has grown increasingly intimate. When talking about Zhengzhou, we cannot forget the Yellow River—once flowing through and nurturing the city. It is no exaggeration to call the Yellow River the "Mother River": it has embodied the love, hatred, joys and sorrows of the people living along its banks for tens of thousands of years. People yearn to get close to her yet fear her; for Zhengzhou, the Yellow River is not as purely beautiful as it is portrayed in public discourse. Our ancestors shared an ambiguous life-and-death bond with her—neither fully attached nor entirely distant.

Through countless drill holes and natural sections across the Zhengzhou region, we have gained a preliminary understanding of this "geological record"—the history of river and mountain migrations, and the transformation of seas into mulberry fields (a metaphor for profound geological changes). We have also deciphered the "humanistic narratives" of environmental history that seem to lack written records over tens of thousands of years. However, this only touches on the shallow-surface geomorphological changes in Zhengzhou; numerous aspects such as astronomical and climatic evolution, as well as deep crustal changes, remain unexplored.

During different archaeological and historical periods, the main and tributary streams of the great river flowed through the western and eastern parts of Zhengzhou, and always through its northern region. The Yellow River served as both the fundamental environmental condition for the survival of ancient people and a catastrophic threat to the existence and development of the people of Zhengzhou. Coupled with concurrent disasters such as severe droughts, extreme cold, plagues, and powerful earthquakes, countless natural factors hindered Zhengzhou's development. Therefore, when we speak of Zhengzhou's favorable environmental conditions, we cannot ignore its disaster-prone environment and climate variability.

Nevertheless, despite numerous devastating natural disasters in history—including catastrophic earthquakes, river breaches, and land submergence—dynastic changes, and the unprecedented migration of ancient core economic zones, the roots and soul of Chinese civilization have been passed down from generation to generation here, never fading away. The reason lies in the Yellow River's presence.

In the mid-Holocene, approximately 4,800-4,700 years ago, the lower reaches of the great river, which had previously flowed entirely through the Hebei Plain into the Bohai Sea during the Yangshao period, gradually shifted southward. Some water and sediment entered the Ji River Basin and Huai River Basin through the Huzi River overflow channel zone, Ji River overflow channel zone, and Bian River overflow channel zone, flooding southwestern Shandong, northeastern Henan, and northern Anhui before emptying into the Yellow Sea and East China Sea. This formed a major course change lasting approximately 600 years (?). This roughly corresponds to the Great Flood recorded in ancient texts during the reigns of Zhuanxu, Yao, and Shun. The so-called Great Flood was characterized by a significant expansion of inundated areas compared to previous floods, as well as exceptionally large flood magnitudes caused by prolonged heavy rainfall.

If you climb Juci Mountain in central Henan, when mist rises and shrouds the surrounding wilderness, you will understand the meaning of the pre-Qin description of the flood as "vast waters embracing mountains and submerging hills" (from ancient classics). When you see the carvings of "water currents" running straight southeastward on the boulders along the mountain ridge of Juci Mountain, can you believe that these might be the "completion drawings" of the water systems in eastern Henan after Dayu controlled the floods?

During comprehensive investigations of the 2021 Zhengzhou floods, you will feel a sense of temporal-spatial transcendence of the Longshan-era flood landscapes at numerous archaeological sites. You will witness modern concrete urban complexes around Zhongzhou Boulevard submerged in nearly one meter of water, while the nearby Dahecun Cultural Site Museum stands majestically amid the inundation. When floodwaters from the Wudu River at Songshan Mountain in 2021 reached the eastern wall of Yudu Yangcheng (the legendary capital of Dayu), you will surely experience a profound sense of temporal-spatial traversal—the moment when ancient floodwaters of the Wudu River eroded the city wall of the small northeastern town within the royal city...

Approximately 4,200 years ago, the southward-flooding waters of the Yellow River followed the aforementioned overflow channels before gradually shifting northward. They retreated from northeastern Henan and southwestern Shandong, returning to the large fault zone at the eastern foot of the Taihang Mountains. Centered on the Yu River (the legendary course of the Yellow River regulated by Dayu), a new set of overflow channels formed, flowing through the Hebei Plain into the Bohai Sea.

Organized by their clan and tribal leaders, the ancient people formed new tribal alliances to jointly combat the floods. They dredged and restored the original water systems in northeastern Henan and southwestern Shandong, allowing the waters to flow "along their natural courses." Waterlogging was drained, flooded lands

were reclaimed for agriculture and sericulture, and the people finally lived in peace and prosperity. Over centuries of flood control efforts, the regional cultures of Yanzhou and Yuzhou merged, social integration deepened, and profound transformations occurred in social and cultural structures, accompanied by a leap in political civilization. This gave birth to China's earliest state—a centralized power forged through flood control. Yellow River civilization thus underwent a dramatic qualitative leap. This is the essence of the water and political culture behind the legend of "Dayu's flood control" centered on the lower reaches of the Yellow River.

The Zhengzhou region stood at the forefront of this epoch-making transformation. Yangcheng, the legendary capital of Dayu, was located at Songshan Mountain in Zhengzhou, and the main base camp of the tribal alliance led by Dayu's clan for flood control was situated in the Zhengzhou Region. They mobilized flood-control clans from across the Central Plains to address the national crisis, including the Youli Clan (有鬲氏), who resided in present-day Shan County (known for their expertise in water management). This clan left their hometown to regulate the Yellow River near the estuary of the "Nine Rivers"—in present-day Dezhou, Shandong.

Such large-scale engineering projects and mass relocation of people could only be accomplished by a centralized state, reflecting its commanding authority and grand demeanor. Gaze into the deep and penetrating eyes of the King Yu statue on Guangwu Low Hills—he witnessed all these events unfold!

After the Yellow River's floods in eastern Zhengzhou largely ceased, Xia culture and Early Shang culture gradually emerged in the region. Eastern and central Zhengzhou underwent development and expansion: shielded by Guangwu Low Hills, it was no longer threatened by the Yellow River's floods. As the western terraces gradually uplifted, lakes and marshes shrank, expanding the area of lacustrine terraces. The Suo and Xu rivers also developed rapidly, with their riverbeds deepening and incising. Yangshao and Longshan cultural sites flourished in present-day Xingyang, making it the region with the highest density of cultural relics. I recall the observation of Li Boqian, a prominent archaeologist from Peking University, during his inspection of the hinterland of Xingyang: it is no wonder that no Peiligang cultural sites have been found here—for this area was once covered by extensive lakes and marshes.

In central and eastern Zhengzhou, the Xing Marsh and Putian Marsh, along with numerous rivers flowing into the Ji River and other lakes, nourished all living things, forming a network of rivers and lakes. Backed by the uplifting landmass in the west and south, the core area developed into a strategic hub for trade, production, and military affairs during the Early Shang period. Eventually, the foundation was laid for the construction of Shang Bo (the capital of the Early Shang Dynasty), which evolved into the largest imperial capital in East Asia. This magnificent capital, the earliest built in Yellow River civilization, marked a landmark event in Early Shang civilization.

Exploring the Zhengzhou Shang City, one can also discern the influence of the Longshan-era Yellow River overflow channels and the lake-marsh complexes in the north, east, and south on the planning of the city's outer and inner walls. The initial water environment in the surrounding area influenced and constrained the city's construction while enriching its water culture. It was precisely this urban planning that shaped the contest between the Xia and Shang dynasties: "When the Yi and Luo rivers dried up, Jie of Xia perished; when the waters of Zheng thrived, Tang of Shang rose." While the other declined, we thrived.

Furthermore, in the early years of the Early Shang Dynasty, the Central Plains faced an ultra-long drought—a century-long aridity spanning Asia and Africa. Thanks to the water resources from the rivers and lakes in Zhengzhou, Early Shang culture continued to flourish. In contrast, the splendid Indus Valley

Civilization, which existed around the same period, ultimately perished. Does this reflect a kind of historical inevitability bestowed on the people of the Yellow River by Yellow River culture?

Western archaeological teams are still searching for traces of ancient civilizations along the Indus River. Similarly, our Shang archaeological team has been excavating ancient water supply ditches one site after another. Could the water sources supporting the Shang City in ancient times have originated from piedmont depressions southwest and south of the outer city wall? The catastrophic floods in Zhengzhou in 2021 seemingly reaffirmed the existence of these ancient water areas.

Archaeological investigations of Neolithic cultures in Zhengzhou have also uncovered suspected traces of ancient earthquakes at a series of sites, including Shuanghuai Shu, Dahecun, Lianghu, Qingtai, Xuecun, Xishizhao, and Yewang. These findings prompt us to explore other factors threatening urban safety from a longer historical perspective. In our research, we have recognized the significance of sorting out ancient environments and disaster-prone contexts for contemporary Zhengzhou's urban construction, economic and social development, and spiritual civilization progress.

The basic concepts and experiences of urban construction during the Early Shang Dynasty laid the foundation for the development of early Chinese imperial capitals. These principles were further developed and refined in the subsequent Zhou Dynasty, forming the institutional norms for the construction of feudal royal capitals. Zhengzhou's status as an ancient capital of eight dynasties is largely attributed to the civilization of the Shang City.

Despite the constant changes in dynasties, imperial capitals, and their political and economic centers throughout history, an examination of the shifts in China's core economic, political, and cultural regions across dynasties (as noted by Karl Wittfogel[1] and Ji Chaoding[2]) reveals that the mainstream economic and cultural roots of modern China remain deeply intertwined with Yellow River Culture—political culture originating from the Loess Plateau and spreading outward from Zhengzhou. It is undeniable that our deep-rooted concepts, value orientations, and driving forces for development are closely linked to Yellow River Culture.

When discussing the Yellow River in Henan, we cannot avoid mentioning Zhengzhou. Similarly, when talking about historical China, we must refer to Henan and Zhengzhou—home to the Yellow River Culture, which embodies the inseparable integration of water, land, and humanity.

To summarize the changes of the Yellow River: during the late Pleistocene, there were two divergent overflow channels (eastern and western) of the Yellow River in the Zhengzhou region, both flowing southeastward—running through Zhengzhou and entering the Ying River overflow channel zone. In the early Holocene, following the glacial thaw, a century-long great flood occurred, advancing along these major overflow channels, submerging the Zhengzhou area, and shaping the basic geomorphological conditions of the region. Meanwhile, the western Guangwu overflow channel dried up and disappeared in the early Holocene, while the eastern Guangwu overflow channel persisted, occasionally shifting southward.

Between 7,000 and 4,000 years ago, leveraging the remaining river valleys, east-west lake groups developed, then gradually shrank and vanished—with the eastern lakes surviving until the late historical period. During the Longshan period, the main course of the Yellow River surged southward through Wuzhi and Yuanyang into eastern Zhengzhou, entering the Bian River and Ying River overflow channel zones. All rivers

[1] Karl Wittfogel (1896-1988), also known by his Chinese name Wei Fugu, was a German-born American historian, sinologist, and sociologist.
[2] Ji Chaoding (1903-1963), a renowned Chinese economist and international activist.

in Zhengzhou became tributaries of the Yellow River, a situation that lasted approximately 500 to 600 years and did not fully end until the era of Dayu. This laid the foundation for the great river pattern of Zhengzhou during the Xia, Shang, and Zhou dynasties.

By the Qin-Han transition period, the dikes on both banks of the Yellow River were unified and improved. The Jin Di (Golden Levee), originating from the Zhengzhou region, marked the beginning of the era of human channelization of the great river.

One hundreds thousand years, ten thousand years, four thousand years, more than two thousand years—these are the key temporal and spatial nodes of environmental change in Zhengzhou's Yellow River history. Grasping these nodes may allow us to gain some insight into the mysteries of the Yellow River's environmental history.

The spirit of Yellow River Culture, as I perceive it, is the very essence that sustains the Chinese nation's man-land relationship, drives economic and social development, and upholds national unity—it embodies a spirit of tireless striving, self-improvement, and unwavering perseverance of the entire nation. To promote national culture, we must highlight our efforts to study and inherit this time-honored Yellow River Spirit passed down from generation to generation, thereby enhancing national confidence and uniting the national spirit.

It has been fifty years since I first recognized the fact of the Yellow River's flooding into the Huai River Basin through my participation in water conservancy projects in Henan. Building on this realization, I studied under contemporary masters of Chinese studies and gained exposure to historical geography and the history of the Yellow River. In 1984, I participated in the first survey of the Yellow River's old courses organized by the Yellow River Conservancy Commission (YRCC), which included investigations of the eastern Henan flood plain and the northern Henan old course. Additionally, advising graduate students from my alma mater, Wuhan University of Hydraulic and Electric Engineering, on their theses led me into the profound palace of the Yellow River and its cultural history.

This collection *The Yellow River and Zhengzhou from an Environmental History Perspective* compiles some of my insights and reflections from exploring the Yellow River and disaster-prone environments over the past forty-odd years.

On the occasion of compiling this collection for publication, I cannot help but look back and cherish the memory of the many seniors who guided me to understand the Yellow River (and also thank the academic friends who have supported me along the way). They are:

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XU Hailiang
Scholar of the Yellow River's Natural History and Culture
Mobile: +86 13261152484
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